

NX-414

**Brain-like computation and intelligence**

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Cursus	Sem.	Type
Computational biology minor	E	Opt.
Data science minor	E	Opt.
Life Sciences Engineering	MA2, MA4	Opt.
Neuro-X minor	E	Opt.
Neuro-X	MA2, MA4	Obl.

Language of teaching	English
Credits	5
Session	Summer
Semester	Spring
Exam	Written
Workload	150h
Weeks	14
<b>Hours</b>	<b>4 weekly</b>
Lecture	2 weekly
Exercises	2 weekly
<b>Number of positions</b>	

**Summary**

Recent advances in machine learning have contributed to the emergence of powerful models of animal perception and behavior. In this course we will compare the behavior and underlying mechanisms in these models as well as brains.

**Content**

This comparison will be done based on contemporary models of vision, audition, touch, proprioception, motor control, language, and cognition.

**Content**

- Classical models of sensory, motor and cognitive function
- Goal-driven and data-driven brain modeling
- Hierarchical and recurrent neural network models
- Comparing models to neural data
- Comparing models to behavioral data
- Modern tools for quantifying behavior

**Keywords**

Python, NeuroAI, Deep Learning, Perception, Behavior, Motor Control and Learning

**Learning Prerequisites****Recommended courses**

CS-433 (strongly recommended)

**Important concepts to start the course**

Programming in Python, good mathematics and machine learning background

**Learning Outcomes**

By the end of the course, the student must be able to:

- Formulate models of brain function
- Hypothesize potential mechanisms that give rise to behavior
- Design models of brain functions
- Characterize current models of brain function

### Transversal skills

- Set objectives and design an action plan to reach those objectives.
- Demonstrate the capacity for critical thinking
- Write a scientific or technical report.
- Summarize an article or a technical report.

### Teaching methods

Lectures and exercises to discuss and work on problem sets (both numerical and analytical). There will be one project as part of this class, which is partially done outside of the classroom.

### Expected student activities

Attend lectures and take notes during lectures, participate in quizzes and read scientific articles. Solve the problem sets and take the final exam.

### Assessment methods

The final mark is a combination of three evaluations: class project (30%), quizzes (20%), final exam (50%).

### Supervision

Office hours	Yes
Assistants	Yes
Forum	Yes

### Resources

#### Virtual desktop infrastructure (VDI)

No

#### Moodle Link

- <https://go.epfl.ch/NX-414>